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THE *PALPATA* GROUP OF THE GENUS *EUPITHECIA* WITH NOTES AND DESCRIPTIONS (LEPIDOPTERA, GEOMETRIDAE) *

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A small group of *Eupithecia* species, of which *palpata* Pack. is probably the best known to eastern American workers, forms a compact entity, almost worthy of at least subgeneric designation. In all the species the palpi are very long and porrect, compressed laterally, presenting in consequence a blade-like appearance. In the male genitalia the uncus terminates in *a single fine point*, in contradistinction to the dorso-ventral bifid nature of this organ in the majority of *Eupithecia* species. The claspers are very *long and thin* with upcurved apex, and the costa generally with a slight bulge in its central section; in most species there are no basal hair pencils but the bases of the claspers themselves are frequently clothed with long hairs. The aedeagus is generally chunky and the main armature consists of a *twisted piece of semicylindrical chitin* of varying length and contour. The ventral plate of the eighth abdominal segment consists of *two long chitinous rods*, narrowly connected at their bases and with their apices frequently incurved and more or less spoon-shaped. In the female genitalia the bursa is rather small, either *globular* or more frequently *moccasin-shaped* with broad, blunt toe-section; it is produced caudally into a *blind sac*. The membranous ductus bursae enters the bursa dorsad and somewhat cephalad of this sac. The larvae are very imperfectly known, but in cases where the early stages have been worked out, prove to be conifer-feeders. The moths are of varying size, generally of a smoky or ochreous-brown color with obscure maculation; the most noticeable feature of the maculation and one which occurs most frequently throughout the group is the darkening and thickening of the t. a. and t. p. lines which then form two prominent parallel, inwardly oblique lines bent in and frequently sharply angled below the costa.

The main area of distribution of the species appears to be the Pacific Coast and the Southwestern States. Only two species, as far as is known, occur in eastern America; these are *palpata* Pack. and the very similar (at least superficially) *columbiata* var *erpata* Pears. The identity of *palpata*, which had been confused by Packard in his monograph with *luteata*, was satisfactorily cleared up by Swett (1908, Ent. News XIX, 196) and a figure of the female genitalia was recently given by me (1940, Can. Ent. LXXII, 36, Pl. III, fig. 3). In the male the antennae are very feebly ciliate and the two chitinous rods of the ventral plate are rather straight, roughly parallel and not very widely separated, frequently, in dried specimens, crossing each other at their apices. In the genitalia the clasper shows a strong costal bulge, hair pencils are lacking and the rather chunky aedeagus is armed with a long, semicylindrical piece of chitin.

The allied *erpata* Pears. is easily recognized by the presence of a distinct black band across the second abdominal segment, lacking in *palpata*. The male antennae are similar to those of *palpata* but the palpi are somewhat shorter and the male ventral plate is quite characteristic; the two rods bulge outward quite strongly in the basal half and then are sharply contracted, the whole presenting a lyre-like appearance. The clasper is considerably shorter and thinner than in *palpata* with weak hair-pencils at the base; the aedeagus is thinner and nar-

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rowed apically and the piece of chitin is much shorter. The female genitalia also show good characters, the neck of the bursa being abnormally long, weakly chitinized and strigate, with the left side decidedly convex and the ductus seminalis arising dorsally near its base on the left side; the entire surface of the bursa is finely spined. As already indicated (1929, Can. Ent. LXI, 62) I can find no differences between eastern *erpata* and the British Columbian *columbiata* Dyar, this latter name having priority; I retain the two names doubtfully in a racial sense for the present.

Longidens Hlst. and *albimontanata* McD., obviously allied to *palpata*, have recently been discussed by me and their female genitalia figured (1940, *op. cit.* 35, 36). It might be noted that in *albimontanata* the ciliations of the male antennae are distinctly longer than in *palpata*, a character not noted in the original description. In the ventral plate in dried specimens the rods thicken and touch in their preapical section, the terminal portions being again convex and forming together an elongate O.

Of *longidens* Hlst. I have no males before me but a genitalia drawing based on a slide in the U. S. National Museum, shows the rods of the ventral plate shorter and thicker than in *palpata* and possibly slightly wider apart; the clasper is considerably thinner.

Kerrvillaria C. & S. is represented in our collection by a topotypical pair, the female abdomen being unfortunately missing. Judging by the male genitalia, the species must be closely allied to *longidens*. It also has the same type of maculation with distinct oblique dark t. a. and t. p. lines but the ground-color is a pale ochreous and not the smoky-gray of *longidens*. The male antennae are somewhat more strongly ciliate than in *palpata*. The correct placement of *kerrvillaria* will have to remain in abeyance until a female genitalic slide can be made, which may show better characters than does the male.

The wide-spread Rocky Mt. and Pacific Coast species, *maestosa* Hlst. with its rather poorly defined races or forms, *harlequinaria* Dyar and *dyarata* Tayl., has been already discussed in several of my papers (1929, *op. cit.* 62; 1936, *op. cit.* 259; 1940, *op. cit.* 37, Pl. III. fig. 5) and a figure of the female genitalia given in the 1940 article. The palpi are very similar to those of *palpata*, being slightly longer in the female sex than in the male; the male antennae are very finely ciliate as in *palpata*; the abdomen shows a fairly definite black band crossing the anterior portion of the second segment. The rods of the ventral plate in the male are widely separated in the basal 2/3, being gently and evenly outwardly bowed, the tips spoon-shaped and in dried specimens generally crossing one another. The primaries are, in the typical form and var. *dyarata*, dark smoky gray, in *harlequinaria* more variegated with light brown, especially along the veins; the maculation consists of numerous cross-lines but is generally obscure and difficult of description; the t. p. line however, is mostly fairly evident, edged internally in the region opposite the cell by a short series of dark dashes or arrow-marks.

The closely allied *laisata* Stkr. has been heretofore misidentified by most workers, including myself. Recently through the co-operation and courtesy of the Field Museum, Chicago, I have been enabled to make a slide of the genitalia of the female holotype. These genitalia agree exactly with those of my recently described and figured *diegata* (1940, *op. cit.* 36, Pl. III. fig. 4) which name falls, therefore, into the synonymy. My type specimens of *diegata*, it might be noted, are much smaller than normal *laisata* from the San Francisco Bay region and when more material from the southern locality is available the name may be held in a racial sense. From *maestosa* the true *laisata* may be separated, apart from genitalia, by the longer and paler-colored palpi; the forewings show a distinct olivaceous tinge which tends in worn specimens to light ochreous; the vestiture of the abdomen is strongly suffused with ochreous and the dark band is brown rather than black. The male antennae show slightly longer cili-

ations than in *maestosa* and appear somewhat more serrate, due to the projection of the dorsal scaling over the lateral edges.

Insolabilis Hlst., described from Arizona, is unknown to me as an adult. I possess, however, a drawing made from a genitalic slide of the female holotype in the Rutgers College collection some time ago. This, together with the long palpi mentioned in the original description, would seem to place the species definitely in this group; it would appear to be an obscurely marked species without discal spot. In the female genitalia the bursa is more or less globular, spined over the entire dorsal surface, but unspined on the ventral side; the neck is very broad at its junction with the bursa and shows a rather strong outward bulge on the lower left side, opposite which, on the right side, is the exit of the ductus seminalis.

In the course of my studies of the genus material representing several undescribed species belonging to the *palpata* section of the group has accumulated. Although in some instances the specimens are not in the best condition — an unfortunately far too prevalent occurrence in Eupithecias — I am describing them at the present time as I believe that with the accompanying illustrations of genitalic detail they should not be hard to identify.

Eupithecia carolata n. sp.

Male. Antennae thin, faintly dark-ringed, strongly ciliate, the ciliae being distinctly longer than in the closely allied *albimontanata* McD. Palpi of the usual long blade-like form but shorter than in *albimontanata* and paler in color, being light buff with little black sprinkling. Head with a patch of whitish scaling behind the antennae, collar and thorax with mixed pepper-and-salt scaling, becoming largely smoky on the metathorax. Primaries rather pointed apically with pale whitish ground-color, heavily suffused with blackish scaling; maculation much as in *albimontanata*, the somewhat thickened, blackish t. p. line being the most prominent feature; this line is less incurved at costa than in *albimontanata*. Slight smoky shade-patches terminally opposite cell and at tornus, the latter with small central whitish spot representing the otherwise obscure s. t. line. Discal spot represented by a small, thin, dark dash, below which a somewhat waved, blackish line, parallel to the t. p. line, runs to the inner margin. A dark marginal line, slightly broken by white dots at ends of veins. Fringes weakly checkered. Secondaries whitish, suffused with blackish scaling in outer half; there are traces of an antemedian dark line, best seen above inner margin; a thicker curved postmedian line is also fairly obvious and a subterminal line can be traced in the costal half of wing. A small discal dot is evident and the margin shows the same dark border as on primaries. Beneath shiny whitish, almost silvery, with discal spots and postmedian lines more prominent than on upper side; subterminal lines also indicated. Expanse 21 m.m.

Genitalia. Very similar to those of *albimontanata* but the chitinous piece in the aedeagus considerably shorter and chunkier. The bars of the ventral plate are considerably shorter, not widely separated and subparallel; their apices are feebly incurved and weakly spoon-shaped.

Holotype — ♂, Charleston Mts., Nevada, May 11, 1934, (G. & J. Sperry). No. 5416 in Canadian National Collection.

Eupithecia castellata n. sp.

Female. Antenna simple. Palpi long, but scarcely either as long or as pointed as in the same sex of *albimontanata*; light grayish-white with lateral smoky shading. Head largely scaled with gray-white. Thorax probably clothed with an admixture of pale and smoky scaling but too denuded to describe accurately. Primaries rather similar in color to the preceding species but of a somewhat more smoky-gray tinge. Dark t. a. and t. p. lines fairly obvious, parallel to each other and *gently rounded inwardly* at costa. The subterminal and

terminal areas are *deep smoky brown*, separated by a fine *whitish non-crenulate* s. t. line, best seen in costal half of wing and terminated at tornus by a faint pale spot; this dark area is separated from the t. p. line by a band of pale color through which the usual fine hair-line runs. Dark discal dot round and quite prominent. The usual broken dark terminal line and palish fringes slightly checkered with smoky. Secondaries pale smoky-white with the outer area sprinkled with smoky scaling and with moderately well-defined antemedian, postmedian and sub-terminal lines and a small dark discal dot. Beneath whitish with the discal dots and postmedian lines strongly defined on both wings; on primaries the s. t. line is very broad and distinct in costal half of wing but obsolescent toward inner margin and on secondaries. The dark marginal line is well-developed. Expanse 20 m.m.

Genitalia. Ductus bursae short and rather broad, membranous, entering the bursa-neck, as usual, dorsad of the small blind sac. Neck chunkier than in allied species, *entirely membranous* but feebly strigate longitudinally. Bursa bluntly moccasin-shaped, the toe pointed toward the left (right in figure). A spined area starts below the neck on the left side and extends down this side and across the fundus to about halfway up the right side, leaving a *large central area on both dorsal and ventral surfaces* and *the entire upper right section unspined* and membranous. The ductus seminalis has its broad inception *dorsally somewhat to the right* (left in figure) and bends cephalad, gradually narrowing, before turning caudad.

Holotype — ♀, Castella, Calif. June 13, 1939 (G. & J. Sperry). No. 5417 in Canadian National Collection.

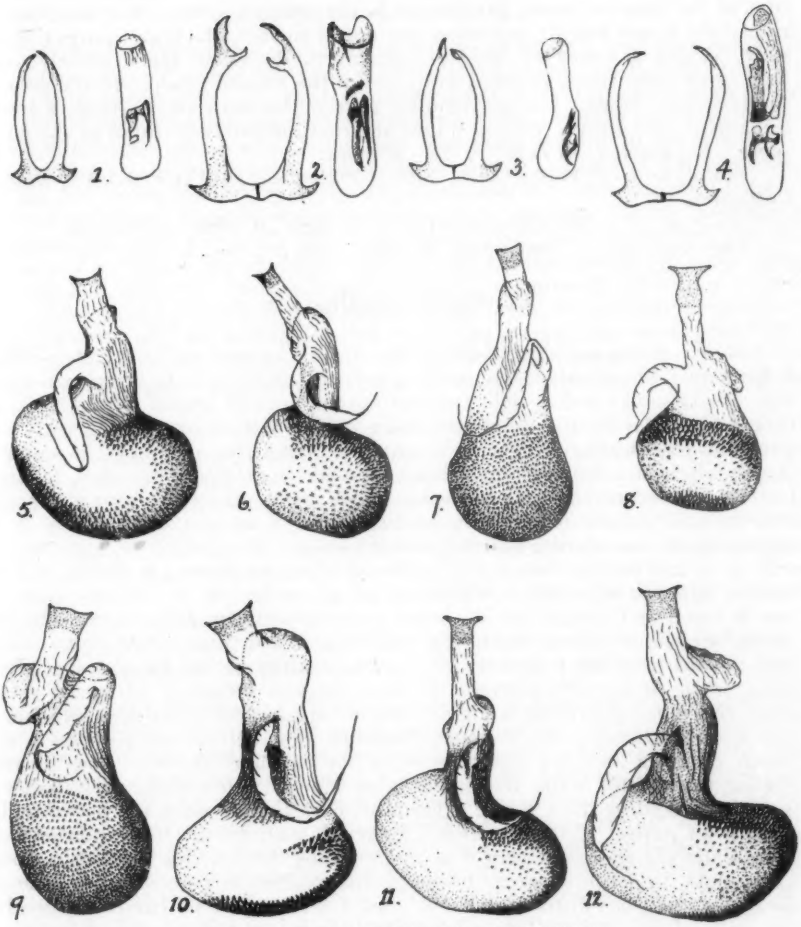
Paratype — ♀, Chester, Calif. June 28, 1934 (G. & J. Sperry).

Eupithecia terrestrata n. sp.

Female. Antennae thin and very weakly ciliate. Palpi long as usual, light fawn-brown, rather heavily shaded with smoky. Vestiture of head and thorax (as far as can be seen) similar in color to that of palpi. Forewings rather even dull fawn-brown with a faintly deeper shade along the outer marginal area. All maculation very obscure except a rather prominent black discal dot or streak; the costa shows some dark blotches, notably at the inception of the t. p. line and halfway between this and apex of wing; t. a. line scarcely indicated; t. p. line better defined, gently rounded outwardly below costa and emphasized by faint dark dashes on veins; between the t. p. line and the outer darker area is a somewhat paler band of color containing a few feeble dashes on the veins; s. t. line scarcely traceable, best indicated by small pale spots between veins 3 and 4 and above tornus. Fringes concolorous, faintly checkered with smoky. Secondaries somewhat paler than forewings especially in basal half, with small discal dot and indications of the usual cross-lines; the outer margin is rather straight from apex to vein 3, forming a slight angle at the termination of this vein. Beneath pale smoky with prominent dark discal spots on all wings. The postmedian dark line is better indicated than on upper side, especially in costal half of primaries, where it becomes quite broad. There are also indications of a subterminal dark line, parallel to outer margin and small dark blotches on costa indicating inception of t. a. and median lines. Terminal dark line well-defined and fringes more noticeably checkered than on upper side.

Genitalia. Ductus bursae short, of moderate width, entering the bursa-neck dorsally and somewhat cephalad of the rounded end of the blind sac. Neck of bursa membranous and gradually expanding toward its junction with the bursa proper, the ductus seminalis arising near its distal end on the left side (right in figure) as a rather narrow tube which proceeds caudad for a short distance and then bends cephalad and crosses the dorsal surface of the bursa. Bursa pear-shaped, finely spined over its entire dorsal surface, the spines extending very weakly backward along the right side to a point opposite the exit

PLATE IV



THE *PALPATA* GROUP OF *EUPITHECIA*

Male ventral plate and aedeagus of — 1. *E. carolata* n. sp.; 2. *E. catalinata* n. sp.; 3. *E. terrestrata* n. sp.; 4. *E. owenata*, n. sp. Female genitalia (dorsal view) of — 5. *E. castellata* n. sp.; 6. *E. chiricahuata* n. sp., 7. *E. terrestrata* n. sp.; 8. *E. edna* Hlst., 9. *E. owenata* n. sp.; 10. *E. longipalpata* Pack.; 11. *E. sabulosata* n. sp.; 12. *E. unicolor* Hlst.

of the ductus seminalis. The ventral surface is largely membranous or with only indications of extremely feeble spining with the exception of a narrow band of weak spining crossing the proximal section.

Male. In a single male before me which I am inclined to associate as the opposite sex, the color of primaries is considerably deeper brown (possibly due to the fresher condition). The general obscure nature of the maculation matches that of the females closely but the size is noticeably smaller. The antennae are rather thick and heavily scaled on the dorsal surface, the scales projecting outward to give a somewhat serrate appearance; the ciliae are definitely longer than in *carolata*, being much as in species of the *filmata* group. In the genitalia the aedeagus, besides a small, chunky, curved chitinous piece, shows a further armature of 3 - 4 thin, pointed spines, situated immediately distad of the curved piece. Expanse, ♂ 18 m.m.; ♀ 20 - 22 m.m.

Holotype — ♀, Globe, Ariz., July 1, 1921. No. 5418 in Canadian National Collection.

Allotype — ♂, Sta. Catalina Mts., Ariz., July 20, 1938 (O. Bryant).

Paratypes — 2 ♀, Jemez Spgs. N. Mex., July 29, Aug. 7.

Eupithecia catalinata n. sp.

Male. Antennae thin, weakly ringed with brown and *very finely ciliate.* Palpi very thin and blade-like, with appressed scaling of a light ochreous color mixed with smoky and a slight tuft ventrally at apex of second joint. Head and thorax clothed with the usual admixture of pale and smoky scaling with small patch of pale scaling between the antennae, and the metathoracic scutellum largely blackish. The abdomen shows signs of lateral black lines but (as far as can be told) there appears to be no black band across the second segment. Primaries of a light fawn-brown, suffused over a whitish base, and with the rather diffuse maculation of a deep smoky color. Maculation of basal area obscure, t. a. and median lines being indicated by smoky patches or dashes on costa, cubital vein and above inner margin; as far as can be told the course of the t. a. line is much as in other species, being rounded outward below costa and then inwardly oblique. Dark discal dot well-defined and quite prominent, situated well inward from the t. p. line. T. p. line distinct, rather broad, especially at costa, where it is well-incurved; its inner edge is projected backward shortly along the veins, producing a slightly dentate appearance. S. t. line whitish, rather strongly dentate, but in general obscure; it is defined inwardly by a dark blotch on costa and two others opposite the cell and above tornus, all these tending to continue across the line to outer margin; a few slight dark dashes on the veins preceding the s. t. line. Terminal dark line as usual, cut by white dots at ends of veins. Fringes palish, checkered with smoky. Secondaries with margin slightly angled at vein 3 as in preceding species, dull whitish, suffused with smoky in terminal area; traces of antemedian line above inner margin; discal dot small but distinct and well inward from t. p. line; curved postmedian line well-defined and well rounded below costa; traces of a white dentate s. t. line through the smoky outer area. Terminal line and fringes as on primaries. Beneath shiny whitish with discal dots and postmedian lines strongly indicated and with traces of a dark subterminal line. Dark terminal line and checkered fringes as above. Expanse 21 m.m.

Genitalia. Of the usual type but with very characteristically shaped chitinous rods in the ventral plate; these show *strong, pointed, inward projections* shortly below the spoon-shaped apices, a character not found in allied species. The aedeagus also possesses good points of differentiation; in the armature there is a small cluster of weak spines distad of the moderate-sized curved chitinous piece; the apex is bilobed on the dorsal side, one lobe being rounded and smooth, the other weakly spiculate.

Holotype — ♂, Graham Mts. Ariz., July 25, 1933 (over 9500 ft.). No. 5419 in Canadian National Collection.

There are two other similar males from Graham Mt. (Aug. 13) and Sta. Catalina Mts. (Aug. 20) before me but they are in too poor condition to be made paratypes.

Eupithecia chiricahuata n. sp.

Female. Very similar to the preceding species in color and maculation. The palpi are slightly longer and more pointed. The scaling of the head and collar is largely creamy with only scattered smoky scales and the vestiture of the thorax is also paler. The primaries show a somewhat less rounded outer margin and lack almost all traces, except along costa and inner margin, of the fawn-colored suffusion of *catalinata;* the t. p. line shows a sharper angle at the bend below costa and is *considerably nearer to the discal dot;* the inner margin of the subapical costal spot is *outwardly* — not inwardly — oblique. On the secondaries a similar condition prevails. The postmedian dark line is *closer to the discal spot* and is weakly angled, rather than rounded, below costa; the inner margin of the dark terminal shading is bordered by a prominently *dentate* s. t. line, a character not noticeable in the allied species. On the whitish underside the prominent dark postmedian line on both wings shows the same proximity to the discal spot as in the upper side; on the primaries there is a very broad, dark, subterminal shade-line which on the secondaries is represented by a ***dark dentate line.***

Genitalia. These show considerable similarity to those of ***castellata.*** The ductus bursae is longer and thinner; the neck of the bursa is also thinner and shows weak chitinization on the right side (left in figure) distally; the spining of the bursa (although weak) extends on both surfaces over the entire central area, leaving a membranous section only on the right side below the chitinized section of the neck. The exit of the ductus seminalis is similar, being centro-dorsal. Expanse 21 m.m.

Holotype. ♀, Barfoot Park, Chiricahua Mts. Ariz., May 23, 1934. No. 5420 in Canadian National Collection.

While very close to *catalinata* the earlier time of flight and the points of maculation emphasized above would seem to indicate a distinct species.

Edna Hlst. represents a slightly divergent type from the previously discussed group of species. In the male, on which the name was based, the primaries show a prominent dark median band, more or less upright. The figure in the Barnes and McDunnough "Contributions" Vol. I, (4), Pl. XIV, fig 3 (♂ not ♀) gives a good idea of the species. The male antennae are rather stout and the ciliae moderately long. In the genitalia the claspers possess *distinct hair pencils* at their bases. In other respects they follow the usual type; the rods of the ventral plate are rather thin and well incurved apically; the aedeagus, besides the usual piece of curved chitinous armature, shows in the apical section a second larger piece which is doubled back at its proximal end; the claspers show a rather broad rounded apex and little of the costal bulge. In the female, which Hulst described as *ornata,* (figured by Barnes & McDunnough *op. cit.* Pl. XIV, fig. 14, as *exornata*) the dark median band of primaries is generally not nearly so prominent and the primaries have a grayer tinge. My association of *ornata* with *edna* as the opposite sex is based on a small series taken at one time at Jemez Spgs N. M. in which the males are of the *edna* type and the females all belong to *ornata;* this association, while reasonably certain, still remains to be definitely verified. In the genitalia the ductus bursae is rather long and thin and enters the bursa-neck more or less on the right side; the neck is short, stout and membranous with a small blind sac apically on the left side and the exit of the ductus seminalis opposite this on the right side. The bursa itself is globular with a cluster of

fairly large spines in the fundus and an incomplete ring of similar spines proximally, the ends not meeting across the ventral surface; the remainder of the bursa shows traces of very fine spining or spiculation but is practically clear, membranous.

In our collection are two females taken at Banff, Alta., June 26, and one female from Ucluelet, Vancouver Island, B.C. June 23; these are the only Canadian records of which I am aware.

Eupithecia owenata n. sp

A very distinct species but with obvious relationship to *edna* Hlst.

Female. Antennae thin, simple. Palpi moderately long, extremely blade-like and clothed with closely appressed blackish scaling; 3rd joint concealed. Vestiture of head and thorax composed of large, closely appressed scales of a whitish-buff color; anterior margin of front and a thin line in front of the antennae, black. Small lateral metathoracic tufts. Abdomen grayish dorsally with a black band across the 2nd segment; ventrally largely whitish. Primaries with very distinct and contrasted maculation. A small blackish basal area, the outer border of which is angled outwardly on the cubital vein. This is followed by a broad pale area of a light whitish-buff color crossed by several waved, rather indistinct hair-lines; the outer margin of this area — which at the same time is the inner margin of a dark median band — is very irregular, forming a broad outward projection in the cell, a long thin outward tooth on vein 2 and a slight outward tooth on vein 1. A broad black-brown median band occupies the central section of the wing, broader and darker on costa than on inner margin; a dark vertical dash represents the discal dot; the outer margin of the band is sinuate, incurved across the cell and again across vein 1; two rather broad sinuate pale lines parallel this outer margin and run close to it and to each other, lightening considerably the color of the outer section of the band. A narrow pale area borders the dark band and is defined outwardly by a thin brown line. The balance of the wing is rather even black-brown with slight whitish scaling and is cut by an indistinct, faintly crenulate, whitish s. t. line which bends sharply inward above vein 2 and terminates in a small white spot in the subterminal area. Opposite the cell a faint smoky shade precedes the s. t. line and similar shading occurs around the pale tornal spot. A dark terminal line and checkered fringes as usual. Secondaries largely smoky brown, paler in basal 2/3, crossed by a darker subbasal line and a parallel postmedian one, straight, with only a slight angle below costa; a small, dark discal spot; a rather obscure pale s. t. line, weakly dentate in inner half of wing; terminal area as on primaries. Beneath pale smoky-brown, discal dots present on all wings. On primaries the borders of the dark median band of the upper side are indicated by dark cross-lines; a broad dark band occupies the whole subterminal area, bordered outwardly by a fine whitish line, representing the s. t. line of upperside. Secondaries with the upperside maculation more or less repeated.

Genitalia. Ductus bursae short and broad. Bursa-neck very broad and scarcely differentiated from the bursa except for its membranous nature with only light indications of lateral chitinous striations; blind-sac large and bent to the right (left in figure) behind the entrance of the ductus bursae. Ductus seminalis arising at the upper left-hand corner of the bursa-neck and bent cephalad across the neck before curving backward. Bursa sac nearly globular, covered over its entire surface with fine spining.

Male. Similar to the female in maculation but much smaller. Antennae rather feebly ciliate; the segmental incisions deeply cut, so that, viewed sideways, a distinctly serrate appearance is presented.

Genitalia. Bars of the ventral plate gently outwardly bowed; apices weakly spoon-shaped. Aedeagus with the usual curved, chitinous piece small, but the

whole apical half of the organ occupied by a second large piece of chitin, bent double at its proximal end. Distinct hair-pencils present at base of claspers. The armature of the aedeagus and the presence of hair-pencils definitely ally the species with *edna* Hlst. Expanse ♂ 20 m.m.

Holotype — ♀, Arizona (Owen Bryant). No. 5421 in Canadian National Collection.

Allotype — ♂, Arizona (Owen Bryant).

Paratypes — 1 ♀, Graham Mt. Ariz., July 25, 1933; 1 ♀, Barfoot Park, Chiricahua Mts., Ariz., May 24, 1934.

I take pleasure in naming the species for Mr. Owen Bryant from whom I have received much interesting Arizona material.

In *longipalpata* Pack. we have a large species with very long palpi and with quite well-defined small medio-dorsal abdominal tufts (when not rubbed off). The type of maculation is in general similar to that of the smaller *harlequinaria*, the color of primaries varying from light smoky brown to a rather light ochreous, this latter color prevalent in worn specimens. From poor specimens of the following species *longipalpata* may be separated (apart from genitalia) by the rounded — not angled — and less oblique nature of the t. a. line on primaries below costa. Normally the numerous transverse lines serve to distinguish it, the s. t. line expanding into a rather prominent white spot above tornus.

The species was described from California and Packard's figure in the "Monograph" (Pl. IX, fig. 6) is recognizable; it is quite common on Vancouver Is., B.C. from where we have a long series, the time of flight being in June and July.

The male genitalia revert to the more normal type, the clasper being without hair-pencil at base and showing the median costal bulge. The aedeagus is armed with a large piece of curved chitin, distad of which is the merest trace of a small curved second piece; the rods of the ventral plate are rather thick, spoon-shaped apically and not much bowed. In the female genitalia we have a very short ductus bursae, a long, thick bursa-neck, lightly chitinized only on a small dorsal section in the vicinity of the exit of ductus seminalis which is medio-dorsal, bending downward before turning caudad. The bursa is not quite globular, projecting slightly toward the right; the ventral surface is more or less entirely spined but the dorsal surface is unspined except for a small area on the left side which extends downward to the fundus along the extreme left side.

The two final species in the group, *unicolor* Hlst. and *placidata* Tayl. resemble each other in their large size and the sharp outward angle of the t. a. line below costa. The dark inwardly oblique t. a. and t. p. lines form the most striking features of the maculation but a pale s. t. line is usually traceable and the terminal area frequently shows dark streaks extending inward from the margin across the s. t. line. The palpi are long, in *unicolor* as long as in *longipalpata*, in *placidata* somewhat shorter, and the male antennae are thin and very finely ciliate, the ciliae being shorter than in *longipalpata*. The front is very flat, with appressed scaling and the anterior margin narrowly black; a black streak runs between the eye and the base of primaries; there are lateral black lines on the abdomen, but *no dark band* across the second segment.

Unicolor was described from material from Colorado and California but the type in the Hulst Collection is a specimen (abdomen missing) from Soda Springs, Calif., a locality in the Upper Sacramento Valley, and this specimen must be regarded as the holotype. I have three specimens (1 ♂, 2 ♀) before me from Placer Co. Calif., which match the description excellently, the primaries showing the even and distinct "violet red" tinge mentioned by Hulst. In fresh specimens the fine, black t. a. and t. p. lines as well as a waved white s. t. line are distinct but tend to disappear when the specimen is rubbed. *Cenataria* C. & S. was described from Vancouver Is. B. C. and a female paratype is in our

collection; I can detect no difference between the genitalia of this specimen and that of one of my Placer Co. females, and believe, therefore, that the two names are synonymous. However, all my Vancouver Is. material is in poor shape; when better material is available for comparison it may be possible to retain *cenataria* in a racial sense. All our material was captured between late July and early September, mostly, however, in August.

The male genitalia have the rods of the ventral plate stout and outwardly bowed, the left rod being longer than the right one; the apices are strongly spoon-shaped. The aedeagus is armed with a large, chunky, semicylindrical chitinous piece. The female genitalia have a short ductus bursae, a stout neck, rather more strongly chitinized and strigate than usual with a large membranous blind sac jutting to the left apically; the ductus seminalis arises mediodorsally from the bursa-neck with rather large opening, partially bordered with chitin; it bends downward across the bursa before narrowing and turning caudad. The bursa is moccasin-shaped, the toe pointing to the left; this portion is well-spined, the spined area extending around the left side of the fundus; the central portions of the bursa show only very feeble spining which disappears entirely on the right side which is clear, membranous, especially on the dorsal side.

Placidata Tayl. is represented, in the first place, in our collection by three topotypical females, including two paratypes. None of these are in perfect condition but still a fairly accurate idea of the color and maculation may be obtained from them. The general color of primaries is a rather deep smoky-gray with the basal and median area tinged with light brown; there is none of the ruddy suffusion found in *unicolor*; the t. a. and t. p. lines are black, the former showing a very strong outward angulation in the cell. *The palpi are deep smoky, almost black*, and contrast strongly with the pale creamy vestiture of the front. The species appears to be rare in its type locality (Kaslo, B.C.) but I have a series before me from Petaluma, Calif., a couple of specimens from Los Angeles and a single female from Santa Barbara which indicate a distribution down the whole Pacific Coastal area. These Californian specimens show, as a rule, a decided *brownish median area* bordered by the blackish t. a. and t. p. lines, the latter being generally more prominently blackish opposite the cell; a scattered frosting of pale scales in the antemedian and subterminal area frequently (in good specimens) tends to further relieve this brown area; a pale broken s. t. line is visible to a greater or less extent and the blackish terminal dashes interior and exterior to this line vary from obsolescence to a well-defined condition. There seems a certain degree of variability in the depth of the angle of the t. a. line, in some specimens the apex of the angle being further removed from the discal dot than in others; in such cases the initial portion forms almost a right angle with the costal margin. Certain specimens also show a distinct olive-ochreous tinge; in all these I was unable to detect any genitalic differences from specimens of the normal form. The type series of the species was taken about the middle of July; my Californian series indicates at least two generations, certain specimens bearing dates in May and June and others in September and October.

The male genitalia are hardly to be distinguished from those of *unicolor*, the aedeagus being slightly thinner. The female genitalia are also very similar; the ductus bursae is *somewhat longer*, the blind sac is scarcely as large or as projecting, the bursa is smaller with frequently a more projecting toe-portion and the spining of this portion seems to *extend along the base of the neck further to the right* than in *unicolor*, leaving a smaller, clear, unspined area. Such differences, I must admit, are not very convincing, especially since it is almost impossible to secure slides of two bursae with the same degree of inflation and in exactly similar positions. A knowledge of the larvae of the two species and of the life-history would be most helpful in establishing relationships.

Two forms from the San Francisco Bay region have caused me considerable trouble. In both male and female genitalic characters they are so closely allied to *placidata* as to raise doubts in my mind as to whether any satisfactory differentiative characters exist. On the other hand both can be easily segregated and separated (both from each other and from *placidata*) on coloration and superficial appearance. One of these forms has been generally going under the name *laisata* Stkr; the other one was sent me by Dr. W. H. Lange of Half Moon Bay who secured the specimens early in the spring from larvae on a tree of *Cupressus macrocarpa* growing outside his home. With considerable hesitation I am describing these as good species; later on, when more knowledge of life histories in the group are available, they can be relegated to their proper status; the present descriptions will serve at least to call attention to them.

Eupithecia sabulosata n. sp.

Female. General color a pale sandy-ochreous with smoky transverse maculation and a slight frosting of whitish scaling on the primaries.

Antennae simple. Palpi slightly longer and thinner than in *placidata;* their ochreous coloration is obscured laterally with a certain amount of smoky scaling but they are not nearly as prominently blackish as are the palpi of *placidata*. Head pale ochreous without the black anterior border to front found in *placidata*. Thorax light ochreous with smoky suffusion over apical portions of patagia and on scutellum of metathorax; black line at base of wing as in the allied species. Abdomen pale ochreous with slight admixture of blackish scaling medio-dorsally and the usual black lateral lines. Primaries pale sandy-ochreous, with rather faint and thin, smoky t. a. and t. p. lines and heavier dark striae in the terminal area. Basal line represented by a black spot on costa; t. a. line angled sharply in cell as in *placidata*; t. p. line obsolescent, but marked in smoky opposite cell, much as in *placidata*. Discal dot small, distinct; veins, especially in outer half of wing, marked with short, blackish striae. S. t. line white, improminent, slightly broken, heavily shaded with blackish blotches on inner side, these blotches being continued to outer margin of wing by dark dashes, the whole forming the most prominent feature of the maculation. A dark terminal line, broken, as usual, by white dots at ends of veins and palish fringes rather strongly checkered with smoky. Secondaries whitish, shaded with light ochreous along inner margin and outer portion of wing. Traces of blackish shading above inner margin near base; postmedian line feeble, indicated by a dark dash on inner half of wing, not attaining costa; s. t. line a series of small dark spots near outer margin, faintly relieved with white outwardly; terminal black line and fringes as on primaries. Beneath primaries pale smoky with well-developed discal spot and indications of ante- and post-median cross lines in costal half of wing; terminal area suffused with deep smoky, crossing which traces of a white s. t. line may be found. Secondaries whitish with the maculation of upper side weakly repeated.

Male. Similar to female in maculation. Antennae rather short and feebly ciliate. Expanse 18 - 19 m.m.

Holotype — ♀, Oakland, Calif., July 31, 1908 (G. R. Pilate). No. 5424 in Canadian National Collection.

Allotype — ♂, Lone Mt. San Francisco, Calif., Sept. 10, 1909 (F. X. Williams).

Paratype — 1 ♀, Same data as Holotype.

Besides these I have a large female before me, the size of *placidata* (25 m.m.), taken at Oakland on May 6, which may represent a spring generation.

Further a slightly larger female with a more olivaceous tinge to the primaries and stronger maculation in the region of the t. p. line, also from Oakland, Sept. 24. Both these show the same type of genitalia as my type series but have not been included.

In the male genitalia I can find no noticeable differences from those of *placidata;* in the female genitalia (fig. 11) the spining of the bursa seems to be less extended toward the right side than in *placidata* although other features agree.

Eupithecia macrocarpata n. sp.

Much darker in color than the preceding species, being of a rather deep smoky-olivaceous with distinct frosting of white scales and rather heavy and diffuse blackish maculation.

Male. Antennae appear somewhat thicker and shorter than in *placidata* and the ciliae are very slightly longer. Palpi about as in the preceding species but deeper in color and almost as dark as those of *placidata.* Front light olivaceous with only merest traces of black scaling in the lateral corners. Thorax and abdomen smoky-olivaceous, the scutellum of metathorax bordered posteriorly with white and slight white shading emphasizing small blackish medio-dorsal abdominal tufts; the usual black lateral lines on abdominal segments. Primaries rather deep smoky-olivaceous with maculation similar to that of allied species. Basal line indicated by a small black patch on costa and an inwardly oblique, black line between cubitus and inner margin. T. a. line black, expanding to a small patch on costa, rather sharply angled outwardly in cell and then *strongly inwardly oblique* to inner margin at about 1/3, preceded in lower portion by black shading. Discal spot small, black, improminent, crossed by traces of an obscure median shade-line. T. p. line fine, black, parallel to t. a. line, with sharp outward angle below costa; opposite the cell the line is *thickened by black scaling,* a prominent feature of the maculation, and bordered outwardly by a fine white line; below the cell the t. p. line is broken and scarcely more than indicated by dark dots or dashes on the veins. S. t. line white, irregularly crenulate, preceded by a quite prominent series of black dashes or arrow-marks which are continued outwardly by black streaks to the wing-margin, giving a distinctly strigate appearance. Veins, especially in outer half of wing, streaked with black, interrupted by white dots. A fine dark terminal line, edged outwardly by a still finer white line. Fringes dusky, obscurely checkered, and frosted with white scaling. Secondaries dull whitish, tinged considerably with olive-ochre in outer portion of wing and along inner margin. A small smoky blotch on inner margin near base; a small discal dot; a distinct, rather straight, dark postmedian line, fading out as it curves up to costa; traces of a dark, dentate subterminal line, relieved outwardly by white scaling; terminal line and fringes as on primaries. Beneath primaries light smoky, with prominent dark discal dots and the usual dark cross-lines well indicated in costal half of wing; a white, wavy, s. t. line is rather noticeable, being relieved on both sides by deep smoky shading. Secondaries almost pure white with small discal dot, prominent curved dark postmedian line and moderately distinct subterminal line; outer margin rather heavily shaded with blackish; traces of antemedian and subbasal lines across inner section of wing.

Female. Similar in wing-maculation to male but with slightly longer palpi. Expanse 21 m.m.

Holotype — ♂, Half Moon Bay, Calif., Feb. 24, 1938 (W. H. Lange), (bred from *Cupressus macrocarpa*). No. 5422 in Canadian National Collection.

Allotype — ♀, Same data, March 5, 1939.

Paratype — 1 ♂, Same data, February 22, 1938.

In the genitalia I can point to nothing that would definitely distinguish the species from *placidata.* The dark smoky appearance of the primaries with their distinct olivaceous tinge and lack of brown shading in the median area as well as the rather diffuse and more extended maculation render the species superficially rather distinct from *placidata* with its reduced and clean cut maculation.

NEW NEARCTIC CRANE-FLIES (TIPULIDAE, DIPTERA), PART XX

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The preceding part under this general title was published in 1943 (Can. Ent., 75:139-145). In the present instalment I am describing new species of the genus *Tipula* received from various friends, as acknowledged throughout the text. The types of the novelties are preserved in my collection of these flies.

Tipula (Bellardina) warneri n. sp.

General coloration of mesonotum cream-yellow, the praescutum with four gray stripes that are narrowly bordered by black; antennal scape and pedicel yellow, succeeding segments weakly bicolored; knobs of halteres pale yellow; femora reddish yellow, the tips narrowly but conspicuously black; wings whitish, conspicuously marbled with brownish gray and dark brown, the latter areas very restricted; *Rs* long, nearly twice *m-cu*; vein R_3 nearly straight; cell *1st* M_2 unusually small, pentagonal; *m-cu* on M_4 some distance beyond the base; male hypopygium with the caudal margin of the tergite very gently emarginate, with a small glabrous projection on either side of median area; ventral tergal lobes slender, with smooth margins; no rounded knob on ninth sternite at base of dististyles.

Male. Length about 26 mm.; wing 25 mm.; antenna about 4.6 mm.

Frontal prolongation of head buffy above, more reddish brown on sides; nasus short and stout; palpi brown, the terminal segment black. Antennae with scape and pedicel yellow; succeeding segments weakly bicolored, the small basal enlargement darker than the pedicel; intermediate and outer segments more uniform dark brown; verticils elongate. Head light gray, with a median brown vitta and similar lines behind each eye; vertical tubercle very low, simple.

Pronotum dark brown medially, paling to yellow on sides. Mesonotal praescutum with the ground cream-yellow, with four gray stripes, the intermediate pair a trifle more brownish gray; all stripes narrowly but very conspicuously bordered by black, the inner border of intermediate pair a common median vitta that is narrower than the lateral borders of the stripes; humeral and lateral portions of sclerite vaguely patterned with paler brown; central portion of suture conspicuously darkened; scutum cream-yellow, each lobe with two gray areas that are narrowly bordered by black; scutellum gray basally, brownish yellow apically, with a central black dash on basal portion; mediotergite light gray on cephalic three-fifths, the posterior portion darker gray; a central dark line with circular, dark brown spots on either side of basal half; pleurotergite gray, the katapleurotergite light yellow. Pleura with dorsopleural region broadly pale yellow; remainder of pleura variegated with dark brown on a gray ground, the amount of dark color restricted, most evident as a dorsal area, with smaller scattered spots elsewhere. Halteres dark brown, base of stem restrictedly yellow, the knob broadly pale yellow. Legs with coxae light gray, the fore and hind pairs patterned with brown; trochanters reddish yellow, sparsely pruinose; femora reddish yellow, the tips rather narrowly but conspicuously black; tibiae obscure brownish yellow, the tips even more narrowly infuscated; tarsi light brown, passing into black; claws with tooth acute. Wings narrower than in *shastensis*; ground color whitish, conspicuously patterned with brownish gray and dark brown, the latter very restricted; prearcular and costal fields more yellowish; dark areas at arculus and origin of *Rs* very small and inconspicuous; stigmal area small, obscure brownish yellow, narrowly margined with darker; darkened seams at cord very restricted; cells beyond cord unusually darkened but conspicuously variegated with pale, including almost the distal half of cell R_5; paler brownish gray washes over the cells before cord, the spot beyond midlength of vein *1st A* large and diffuse; ground areas in cells before cord small and scattered, relatively inconspicuous against the ground; veins dark

brown, more reddish brown in the brightened basal and costal portions. Venation: *Rs* long, nearly twice *m-cu;* vein R_2 nearly straight, not sinuous on distal third as in *shastensis;* cell M_1 long, its petiole one-half longer than *m;* cell *1st* M_2 unusually small, pentagonal, the second and third sections of vein M_1+_2 subequal in length; *m-cu* on M_4 some distince from base of latter, this section erect.

Abdomen with basal tergites gray, patterned with dark brown; basal sternites reddish yellow, with conspicuous light gray lateral borders that are very narrowly bordered internally with brown; outer segments more uniformly dark brown. Male hypopygium with the caudal margin of ninth tergite, when viewed from above, very gently emarginate; on either side of this emargination with a very small, glabrous, oval projection or flange; on ventral surface with two elongate flattened dusky blades or lobes, these more slender and elongate than in *shastensis,* their margins entirely smooth (microscopically corrugated in *shastensis*). Notch of ninth sternite moderately deep; no rounded knob on posterior margin, at base of dististyles, as in *shastensis.* Outer dististyle somewhat as in *shastensis,* an extensive semicylindrical pale roll, the rounded margins with relatively abundant and conspicuous black setae. Inner dististyle with beak more or less elevated, there being a shallow angle between it and the main body of style; sensory area oval in outline, composed of several pits.

Habitat. Idaho.

Holotype. ♂, Coeur d'Alene National Forest, altitude 4,800 feet, July 10, 1942 (C. L. Warner).

I am very pleased to name this species in honor of the collector, my former student, Mr. Charles Lloyd Warner, now with the armed forces. The most closely related species is undoubtedly *Tipula (Bellardina) shastensis* n. sp., of northern California. The general type of hypopygial structure is much the same in both flies while differing in details. The general appearance, venation and wing pattern of the present fly is quite distinct from *shastensis* and there seems to be no doubt as to the distinctness of the two flies.

Tipula (Bellardina) shastensis n. sp.

Allied to *commiscibilis* and *warneri;* antennal scape yellow; mesonotal praescutum with four grayish brown stripes, the lateral pair almost entire; postnotum light gray, the mediotergite with five brown areas; pleura variegated with dark brown, yellow and gray; femora yellow, the tips narrowly and relatively inconspicuously dark brown; wings obscure yellow, patterned with brownish gray and more restricted dark brown areas; *Rs* about two-thirds longer than *m-cu;* cell M_1 deep, its petiole very short; abdomen reddish yellow, the basal tergites darker sublaterally; outer segments more uniform darker brown; male hypopygium with the outer dististyle unusually extensive, appearing as a more or less semicylindrical rolled plate, provided with relatively few setae, these latter arranged in four groups.

Male. Length about 26 mm.; wing 23 mm.; antenna about 4.3 mm. Frontal prolongation of head above light gray, dark brown on sides and beneath; nasus distinct; palpi brownish black. Antennae with scape and pedicel yellow; basal flagellar segments light brown, the outer ones somewhat darker; verticils long and conspicuous; basal enlargements of segments relatively conspicuous. Head light gray; medial and postocular darkenings distinct; vertical tubercle low and entire.

Pronotum brown medially, the area narrowly bordered by darker; lateral border broadly pale yellow. Mesonotal praescutum with the restricted ground yellow, almost obliterated by four grayish brown stripes, the intermediate pair separated by a narrow brown median line that is darker at cephalic border; on either side of this median vitta with a linear grayish line at near midlength of sclerite; lateral stripes almost entire, bordered by darker only on their cephalic

portion; extreme border of humeral region dark brown, polished; lateral praescutal borders darkened; scutum with median area yellow, each lobe virtually covered by a large brownish gray area that is narrowly bordered by darker; scutellum chiefly dark brown, with a narrow darker spot at base; mediotergite light gray, patterned with brown, including a linear central mark, suboval basal areas on either side and paired circular spots at posterior border. Pleura variegated dark brown, yellow and gray; dorsopleural area broadly pale yellow; a more sericeous pollinose stripe across the ventral pleurites, the anepisternum chiefly dark brown, the ventral sternopleurite dark gray. Halteres brown, the knob dark brown, the base of stem restrictedly pale. Legs with the fore and hind coxae gray, their outer faces infuscated, middle coxae more whitened; trochanters obscure brownish yellow; femora yellow, the tips narrowly and somewhat inconspicuously dark brown; tibiae and tarsi fulvous-yellow, the outer tarsal segments brownish black; tooth of claw low and obtuse. Wings relatively broad; ground color very restrictedly obscure yellow; a conspicuous brownish gray and more restricted dark brown pattern; the darker areas include a relatively small spot in bases of cells *R* and *M;* a spot at origin of *Rs;* stigma and a confluent cloud over anterior cord; seams over posterior cord; extensive darkenings in outer radial cells; a spot at near two-thirds the length of vein *1st A*; extensive darkenings along wing margin, most developed at end of vein *2nd A*; the yellow color occurs especially as extensive areas before and beyond the stigma and anterior cord; outer third of cell R_5 behind vein *Cu* and near bases of cells *R* and *M*; a conspicuous spot near outer end of vein *Cu* in cell *M*; areas on either side of the dark spot over vein *1st A*; conspicuous yellow marginal marks in Anal cells, including two in *1st A*; veins dark brown, more yellowish in the prearcular and costal fields. Venation: *Rs* about two-thirds longer than *m-cu*, the latter at fork of M_3+_4; cell R_3 constricted at midlength; cell M_1 deep, its petiole very short, only about one-fourth *m*, cell *1st* M_2 relatively large, pointed at outer end.

Abdomen with basal tergite brown, the succeeding segments reddish yellow, darker brown sublaterally, the margins restrictedly buffy gray; sternites similarly reddish, the caudal borders restrictedly pale; outer segments and hypopygium darker brown. Male hypopygium with suture between tergite and sternite indicated on its outer two-thirds. Suture of basistyle scarcely evident, apparently about opposite the base of the sternal notch, the basistyle thus very narrow and restricted in extent. Median notch of ninth sternite quadrate; outer angles of sternite, near base of dististyle, produced into a small glabrous lobe; ventral portion of sternite with unusually long and abundant black setae, the median region glabrous. Ninth tergite, viewed from above, with the caudal margin appearing nearly truncate; viewed caudally and from side, the median region is depressed and bears two lobes, with two further larger compressed blades extending from the ventral surface. Pale lobes from beneath the tergite unusually large and conspicuous, oval in outline, their surface microscopically roughened. Outer dististyle of unusual extent, pale, appearing as a more or less semicylindrical rolled plate, the incurved margins more or less overlapping when in their normal position; apical portion of style a little produced, each outer angle of this area bearing more abundant blackened setae; the inner rolled portion likewise with two approximated groups of blackened setae. Inner dististyle much smaller in area than the outer style. Rostrum relatively short and elevated; area of sensory pores relatively extensive, including at least a score of pores.

Habitat. California (Shasta County).

Holotype ♂, Burney, May 30, 1939 (Mont Cazier).

The nearest ally of the present fly is *Tipula* (*Bellardina*) *warneri* n. sp. A comparison of the hypopygial details of the two flies will be found under the discussion of the latter species.

Tipula (Bellardina) calaveras n. sp.

Allied to *commiscibilis*; male hypopygium with the tergite having a small V-shaped median notch; outer dististyle very large and flattened, dark colored, with unusually short but dense setae, its inner lobe a strong curved blade, the apex densely covered with abundant black setae; inner dististyle smaller than the outer, the rostrum elongate.

Male. Length about 25 mm.; wing 24.5 mm.; antenna about 4 mm. Frontal prolongation of head relatively long, dark brownish gray, darker reddish brown on sides and beneath; nasus distinct; palpi brownish black. Antennae moderately long; scape dark brown, its dorsal surface crenulate; pedicel light yellow; flagellum brown, the outer segments passing into darker brown; verticils long and conspicuous. Head light gray, with a broad conspicuous median brown stripe; posterior orbits a trifle darkened; vertical tubercle simple.

Pronotum dark brown, the sides light yellow. Mesonotal praescutum with the restricted ground light yellow; four stripes, the intermediate pair more buffy gray, narrowly bordered by dark brown; lateral stripes dark gray, similarly bordered by dark brown; additional dark brown lines and borders on the humeral and lateral portions of praescutum, the latter wider; scutum with median region golden yellow, each lobe with a brownish gray center, bordered internally and at the suture with dark brown, the latter more extensive; scutellum brownish gray, with a median brown line on basal half, this bordered by yellowish pollinose areas; mediotergite brownish gray with a very delicate median line that appears impressed, on either side of this at near midlength with a yellowish spot; lateral borders of mediotergite restrictedly grayish; pleurotergite chiefly dark brown, with a pale area on the katapleurotergite. Pleura conspicuously patterned with dark brown and creamy yellow, the latter including the dorsopleural membrane and a broad ventral stripe that widens out behind to involve the ventral pteropleurite, meron and metapleura. Halteres obscure yellow, the base of knob weakly infuscated. Legs with the coxae brown, variegated with light gray areas, very extensively so on mid-coxae; trochanters dark brownish gray; femora yellow, the tips rather broadly and conspicuously black, the amount subequal on all legs; tibiae and tarsi yellow, the outer tarsal segments passing into brownish black; claws (male) with tooth low and triangular. Wings marmorate, as in the subgenus; ground color chiefly cream-yellow, variegated with abundant gray and more restricted brown areas; the brown pattern includes marks in postarcular field; origin of *Rs;* stigma and a confluent seam over anterior cord; outer end of cell R_2, crossing cell R_3 into R_5; marginal seams at ends of longitudinal veins, most extensive at R_{4+5} and *2nd A;* the gray clouds include the centers of most cells, in outer ends of cells R_5 and M_1, more nearly of the ground color; posterior cord more narrowly seamed with dark brown, the pattern extending to and along the posterior wing border at this point; a further deepening of the margin in outer end of cell *1st A;* cell *Cu* with three gray areas, the outer one elongate; veins brownish yellow, darker in the clouded portions. Venation: *Rs* unusually long, about twice R_{2+3} or approximately one-half longer than *m-cu*; cell *1st* M_2 small, about one-half as long as cell M_1, the latter nearly three times its petiole.

First abdominal tergite brown, pruinose on sides; succeeding segments reddish, becoming darker brown on outer segments, including hypopygium. Male hypopygium with the ninth tergite separate from the ninth sternite except at cephalic end. Basistyle separated from sternite only by a short weak ventral suture. Ninth sternite with a deep median quadrate notch, the base of which is slightly protuberant. Ninth tergite a transverse plate, its caudal margin convex, with a small, broad, V-shaped, median notch; outer lateral tergal angles produced into small rounded glabrous lobes; dorsal surface of tergite with setae small and relatively sparse, chiefly grouped near

outer lateral portions. From beneath the tergite, on either side, extends a pale membranous lobe. Outer dististyle large and flattened, as in the group; chiefly dark-colored, with unusually short but abundant setae; outer lobe subtriangular, its dorsal edge heavily polished and blackened; inner lobe of style broad at base, bent at nearly a right angle and thence narrowed to the subacute tip; the entire narrowed apical portion clothed with numerous dense black setae to darken the whole area; from posterior basal portion of style juts a small slender lobe. Inner dististyle smaller than the outer; body subquadrate; beak long-produced, its apex flattened and more or less recurved; a group of six or seven sensory pits near the base of rostrum.

Habitat. California (Alameda County).

Holotype. ♂, Sunol, beneath a darkened bridge over Calaveras Creek, March 20, 1939 (T. H. G. Aitken).

Tipula (*Bellardina*) *calaveras* is quite distinct from the more than a dozen regional members of the subgenus, differing especially in the structure of the male hypopygium, particularly of the tergite and outer dististyle. The three species described at this time all have the basistyle virtually fused with the ninth sternite, being separated by a weak ventral suture only.

Tipula (Lunatipula) aitkeniana n. sp.

Belongs to the *californica* group, allied to *californica;* general coloration polished yellow, the praescutum with three more reddish stripes; head and thoracic pleura more pruinose; femora yellow, the tips very narrowly and weakly infuscated; wings whitish subhyaline, most cells with brownish gray centers; abdomen yellow, the tergites trivittate with darker, the median stripe brownish black; male hypopygium of moderate size; inner dististyle massive, the posterior portion produced into two separate lobes or rods; eighth sternite relatively small, each lateral angle produced into a small finger-like lobe that is sparsely fringed with moderately long setae.

Male. Length about 16 mm.; wing 14.5 mm.; antenna about 4.8 mm. Frontal prolongation of head elongate, exceeding the remainder of head, shiny yellow; nasus brown, tufted with yellow setae; palpi brownish black. Antennae with scape and pedicel yellow; flagellum black, the proximal half of basal segment paler; flagellar segments only moderately incised; longest verticils of more proximal segments exceeding the segments in length. Head conspicuously gray pruinose, paler surrounding the antennal bases; a more or less distinct dark median vitta.

Pronotum obscure yellow, more reddish medially. Mesonotal praescutum yellow, with three more reddish stripes, the lateral pair straight; notch of suture conspicuously darkened; scutum yellow, each lobe variegated with reddish; scutellum brown; mediotergite brown, pruinose on cephalic third. Pleura pale, sparsely pruinose, the more posterior sclerites and the pleurotergite clearer yellow; dorsopleural membrane yellow. Halteres brown, the base of stem and extreme base of knob paler. Legs with coxae yellow, sparsely pruinose; trochanters yellow; femora yellow, the tips very narrowly and weakly infuscated; tibiae pale yellowish brown; basitarsi yellowish brown, passing into black; remaining segments black; claws toothed. Wings whitish subhyaline; virtually all cells with darker brownish gray centers, restricting the ground to the vicinity of the veins; stigma dark brown, its proximal end more yellow; areas immediately before and beyond the stigma more evidently whitened than remainder of ground; veins brown, more yellowish brown in the prearcular field. Squama with strong setae. Venation: *Rs* long, about three times *m-cu; M_3+_4* shorter than basal section of M_1+_2.

Abdomen yellow, the tergites trivittate with darker; the brownish black median stripe interrupted by narrow yellow posterior borders to the segments; lateral borders paler, more grayish; sternites reddish yellow, with narrow yellow

posterior borders; hypopygium relatively large, chiefly brownish yellow, the ninth segment dark liver-brown, the eighth sternite more pruinose. Male hypopygium with the ninth segment elongate, conspicuous. Tergite entirely separate from the sternite; basistyle complete, not produced; accessory sclerite of ninth sternite conspicuous. Eighth sternite only moderately sheathing, narrowed outwardly, each lateral angle produced into a small finger-like lobe that is sparsely fringed with moderately long setae. Ninth tergite completely divided down midline by membrane, the lateral lobes blackened, near outer ends produced into a plate that terminates in paired blackened teeth or points. Inner dististyle unusually massive, the beak terminating in an acute blackened point, the posterior portion produced into two separate lobes or rods, in addition to the long setiferous blade common to the group. Gonapophyses united basally, thence separate as slender rods, each bearing several strong setae at apex.

Habitat. California (Santa Clara County).

Holotype. ♂, Mount Hamilton, altitude 3,000 feet, May 19, 1940 (T. H. G. Aitken).

I am pleased to dedicate this species to Lieutenant Thomas Henry Gardiner Aitken, to whom I am particularly indebted for many specimens of Tipulidae from California. The fly is very different from the two other previously described species of the group, *Tipula* (*Lunatipula*) *californica* (Doane, 1908) and *T.* (*L.*) *sweetae* Alexander, 1920, differing in all details of structure of the male hypopygium. The reddish praescutal stripes give to this fly an appearance that is very different from that of the other species but this may prove to be a variable character.

THE PARASITE CATALOGUE OF THE IMPERIAL PARASITE SERVICE

The rapid development of scientific and practical work on parasitic and predaceous insects during recent years has created a need for a work of reference indicating the host relations of the entomophagous species and providing in a convenient form a bibliography of the subject. To meet this need the Parasite Catalogue of the Imperial Parasite Service is now being published. This Catalogue was originally compiled on cards as a basis for the work of the staff of the Parasite Service. Its publication was suggested by the delegates to the Imperial Entomological Conference of 1935 and the British Commonwealth Scientific Conference of 1936 in the belief that it would be useful to entomologists everywhere.

The first instalment of the Catalogue, now in course of publication, comprises rearing records for parasites and predators published during the years 1912 to 1935 inclusive, and is estimated to contain about 100,000 citations. The bulk of the records have been taken from the *Review of Applied Entomology* and papers mentioned therein. When the publication of these records has been completed, it is proposed to publish the records that have appeared since 1935 in a series of supplements, which will be extended to include records anterior to 1912 if the sale of the parts published justifies this further effort.

The Catalogue is divided into four sections which will be issued in the following order:

Section I: Parasite Host Catalogue
- Part 1. Arachnida and Coleoptera
- 2. Dermaptera and Diptera
- 3. Hemiptera
- 4. Hymenoptera, Isopoda and Isoptera

5. Lepidoptera A–C
6. Lepidoptera D–G
7. Lepidoptera H–M
8. Lepidoptera N–P
9. Lepidoptera Q–Z
10. Orthoptera, Psocoptera and Thysanoptera.

Section II: Parasite Catalogue
To be issued in parts of convenient size.

Section III: Predator Host Catalogue

Part 1. Arachnida, Coleoptera, Collembola and Diptera
2. Hemiptera
3. Hymenoptera, Isoptera, Lepidoptera, Mollusca, Myriapoda, Neuroptera, Orthoptera and Thysanoptera

Section IV: Predator Catalogue.

To be issued in parts of convenient size.

In the Parasite Host and Predator Host Catalogues, the names of parasites are grouped under the names of their host insects, assembled in Orders. These Catalogues give the name, family and order of the parasites or predators, the country of record and the bibliographical references. In the section dealing with each Order, the names of host insects are listed according to genera in lexicographical order. Parisites are listed under each host in the same manner. Each part is provided with an index listing all parasites or predators cited under genera in lexicographical order.

In the Parasite and Predator Catalogues host insects are grouped under the names of their parasites and predators, assembled in Orders. These Catalogues give the name, family and order of the parasites, predators and hosts, and the country of record.

In all the parts of the catalogue, synonyms are connected by cross-references so that hosts, parasites or predators may be found under any name used to designate them in any publication cited.

Though the Catalogue is merely a bibliographical guide to the literature on parasitic and predaceous insects, and therefore reproduces some records which are probably inaccurate, yet it constitutes an indispensable basis for investigations on parasite biology or experiments in biological control. The data on host relations often facilitates the identification of reared species and revisional work of various kinds. The Catalogue also provides a good starting point for the study of the general problems of parasite biology; presenting in a condensed and convenient form, data and references scattered here and there through the immense literature of the subject and unobtainable except at the cost of much time and trouble.

For the sake of economy the Catalogue has been printed by the Multigraph method on stout bond paper. The volumes are approximately Crown 4to. Each part is bound separately in cloth-covered boards. The price of the parts is fixed at present at $2.00 (Canadian) each and will be maintained at as low a level as basic costs permit.

Part 1, listing about 1000 species of Arachnida and Coleoptera and about 1300 species of parasites (pp. lx and 151) and Part 2, listing about 600 species of Dermaptera and Diptera, are now ready. Parts 3 and 4 will be issued early in 1944 and the remaining parts will follow at short intervals.

Orders for these volumes should be sent to: The Imperial Parasite Service, Imperial Institute of Entomology, 228 Dundas St., Belleville, Ontario, Canada.

THE FEEDING HABITS OF YOUNG SPRUCE BUDWORM LARVAE*

BY C. E. ATWOOD,
Ottawa, Ontario

The spruce budworm *Cacoecia fumiferana* Clem. is a tortricid moth which periodically appears in vast numbers in the spruce-balsam forests of Canada and the northern United States. When these outbreaks occur, the balsam fir is often killed over areas totalling thousands of square miles. Therefore, this insect has come to be regarded as one of the most serious enemies of pulpwood forests and has attracted a good deal of attention from forest entomologists.

Earlier observers have agreed that the young larvae, which hatch in July and spend the fall and winter in hibernacula on the tree, are unable to eat the old hard foliage of the previous season and that they invariably make their first attack on the new buds. The following quotations are from some of the best known publications on spruce budworm. Swaine and Craighead (1924, p. 33, 34): "The new growth of all trees is preferred and entirely consumed before the old foliage is eaten." "The hibernating caterpillars emerge from their cocoons coincident with or a few days before the balsam buds open. They bore into the centre of the bud entering between the opening scales or directly through the base of the closed bud . . .". Gibson, (1925, p. 201), accepts Swaine and Craighead's account of the behaviour of young larvae. Mathers (1932, p. 154): "The larvae immediately commence to feed either directly on the new growth if such is present or by mining into the unopened buds". Graham (1940, p. 8): "During the early stages they can feed only on fresh foliage."

RECENT OBSERVATIONS IN QUEBEC AND ONTARIO

During the course of observations on spruce budworm in western Quebec and northern Ontario, the writer was impressed by the large number of old balsam and spruce needles which had been mined. These were first observed in late spring, and the identity of the insect causing them was not at first known. More careful observation has shown that these mines are made by young spruce budworm larvae; while a detailed study of all steps in the mining process has not been made, it was thought that the fact that such mines are of common occurrence should be recorded.

This mining habit is of interest not only because of its physiological implications but also because it may be of considerable importance in both natural and artificial control of budworm larvae. In this connection observations by de Gryse (1932) on the early feeding of European pine shoot moth larvae should be noted.

DESCRIPTION OF MINES

Mines were first noted at Laniel, Que., in late spring, 1941. They occurred only in foliage of 1940 or earlier and most of them were empty before May 24. A few larvae were found in them and the identity of the miner was thus determined. It was not known, however, whether the mines had been made in the spring or whether the larvae had mined the needles in the previous fall and had hibernated within the needle. In 1942 it was possible to get into the field before the mining began. No mines had been seen on the trees in late fall of the previous year and none were present on April 20, 1942. By May 1, 1942, mines were common and various stages in their excavation had been seen. The process of starting the mines appeared to be as follows: The larva chose a spot on the lower side of a needle, usually but not invariably on the basal third, where another needle was sufficiently close to be used for a fulcrum. A small web was then spun, connecting the two needles and possibly holding them together and within this shelter a hole was cut through the lower epidermis of

*Contribution No. 2217, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

of the needle. The mine was then continued between the upper and lower epidermis until the larva was completely hidden. Feeding continued until all the mined part of the needle had been eaten and only a shell remained. The larva then emerged and usually attacked an opening bud, although, especially on black spruce, there is some evidence to indicate that more than one mine may be made before the new buds are attacked.

The large numbers of these mines found on spruce and balsam trees indicate that the majority and possibly all of the larvae which came out of hibernation in 1941 and 1942 must have formed mines. The table below shows the numbers of mines present in 1942 on sample branches some 18 inches long clipped from the central part of the crowns of infested balsam trees seven inches in diameter at breast height.

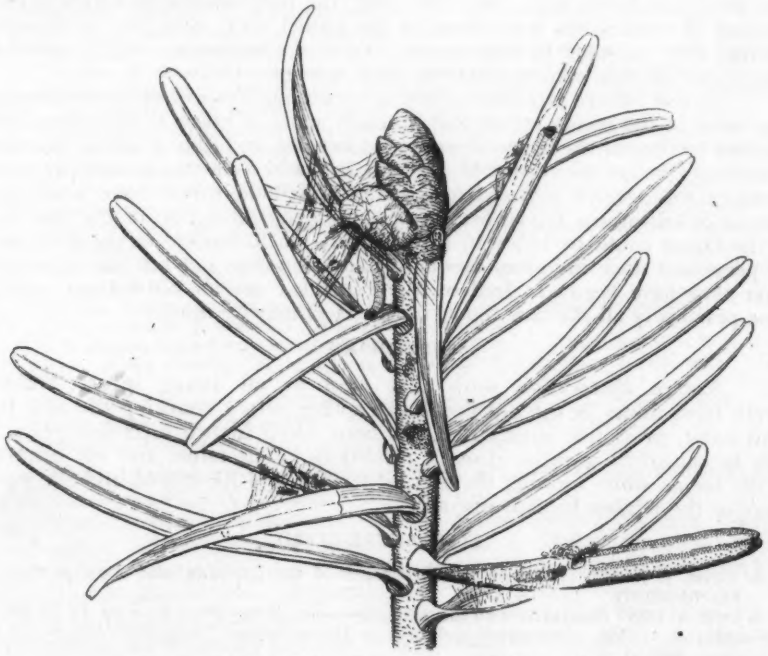

Fig. 1. Feeding habits of young spruce budworm larvae.

Number of mined needles and of budworm larvae on sample branches from infested balsam, Lake Kipawa area.

Date	Locality	No. samples	No. mined needles		No. larvae	
			Total	Ave. per sample	Total	Av. per sample
May 13	White Cr.	10	163	16.3	121	12.1
May 11	Laniel	10	254	25.4	156	15.6
May 15	Gagon Cr.	6	223	37.2	166	27.7

Making due allowance for mortality and for migration to other branches, the agreement between number of mines and number of larvae is sufficiently close to justify the conclusion that practically all the larvae make mines before attacking the new buds in the spring.

After the larvae have left the mined needles, the latter gradually die and fall off, until by mid-summer very few are left on the twigs.

The significance of the mining habit in relation to spruce budworm studies may be briefly noted. Young budworm larvae freshly emerged from

hibernacula are able to begin feeding on old needles of previous seasons' growth, before the current year's buds are open. The unwillingness of third and fourth stage larvae to eat old foliage must be due to a reaction developed after feeding has been carried on for a certain period and not to an inherent inability of young larvae to digest mature needle tissue.

Needle mines formed by young spruce budworm larvae are readily counted in the spring and thus lend themselves to population studies and comparisons from year to year. Due to migration of larvae and mortality in early stages, absolute figures for populations cannot be derived from counts of mines.

The mining habit protects the young larvae from predators and from unfavourable weather in seasons when large numbers of larvae may emerge before balsam buds have opened: the mining habit may indeed be a response to the latter condition, since 1941 and 1942, the only seasons in which extensive mining of needles has been noted in the Laniel area, were two of the earliest springs ever recorded in that region. Further observations will be needed to determine whether mining occurs in other seasons.

In cases where artificial control of spruce budworm is attempted, the mining habit of the young larvae will probably make it easier to kill them. Since the first feeding of the larvae is on the old needles, and since a second excavation is necessary before they can enter the bud, it would seem that a carefully applied spray or dust, which coated both needles and buds, would have a very good chance of killing the larvae before they reach the protection of the new shoot. If the larvae could be killed in this manner, much damage to the trees would be prevented since the usual method of spraying does not kill the larvae until after they have begun to feed on the expanded new or old foliage. By this time practically all the new shoots on the trees may be dead.

SUMMARY

Recent observation show that most or all young spruce budworm larvae form mines in the old needles in spring before attacking the new buds. This habit, previously unreported, has been noted in two successive years, but may be caused by peculiar climatic conditions. The mines and the behaviour of the larvae while forming them are described and illustrated and the significance of the mining habit is discussed.

LITERATURE CITED

1. de Gryse, J. J. 1932. Notes on the early stages of the European pine shoot moth. Can. Ent. 64:169-172.
2. Gibson, A. 1925. Observations on the spruce budworm. Trans. Roy. Soc. Can. 19:195-205.
3. Graham, S. A. 1935. The spruce budworm on Michigan pine. Univ. Mich. School For. and Cons., Bull. 6.
4. Graham, S. A. and Orr, L. W. 1940. The spruce budworm in Minnesota. Univ. Minn. Agr. Expt. Sta. Tech. Bull. 42.
5. Mathers, W. G. 1932. The spruce budworm in British Columbia. For. Chron. 8:154-157.
6. Swaine, J. M. and Craighead, F. C. 1924. Studies on the spruce budworm *Cacoecia fumiferana* Clem. Bull. 37, New Series. Dept. of Agriculture, Canada.

1943 MEETINGS OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

The Eightieth Annual Meeting of the Entomological Society of Ontario was held in the Confederation Building, Ottawa, on November 10, 1943. Council met during the morning. From this meeting the President, Mr. C. E. Petch, carried to the general meeting the decision with respect to the editorial policy of the *Canadian Entomologist*. This decision was "that the policy be to encourage more economic and popular articles and that those directing economic entomology in Canada encourage those working under them to produce suitable papers of this type".

Through the kindness of the Department of Labour, the general meeting of the Society convened in the Board Room of that department at 11.00 a.m.

with the President, Mr. C. E. Petch, in the chair. The financial statement for the year ending October 31, 1943, was presented by the Secretary-Treasurer. After appointing committees on Nominations and Resolutions, the President briefly indicated his gratification at such a large attendance under war conditions. The meeting then proceeded with the presentation of papers according to the following programme:

"A Catalogue of the Parasites and Predators of Insect Pests" — W. R. Thompson
"Aphid Resistance in Potatoes — J. B. Adams
"The Influence of Fertility on the Feeding Rate of the Female Tick, *Dermacentor andersoni* Stiles" — J. D. Gregson
"Hybridization Studies in the Saturdiids" — T. N. Freeman
"A Review of the Japanese Beetle Situation in Canada in 1943" — M. R. Baker
"Progress Report on Biting Fly Repellent Studies" — C. R. Twinn
"The Post Discharge Re-establishment Order" — H. W. Jameson
"The Forest Insect Phase of the Ganaraska Project" — K. E. Stewart
"The History and Present Status of the Spruce Budworm in Canada" — C. E. Atwood
"The Role of Forest Management in Forest Insect Control" — J. J. deGryse
"The Establishment of Some Imported Parasites of the Larch Case Bearer, *Haploptilia laricella* Hbn., in Ontario" — A. R. Graham
"The Status of the European Corn Borer in Ontario" — R. W. Thompson
"An Increase in the Multiple Generation of the European Corn Borer in Ontario and Its Relation to Parasite Establishment" — G. Wishart
"The Status of Insects as a Factor in Grain Storage in Canada" — H. E. Gray
"Some Notes on the Taxonomy of Acarid (Tyroglyphid) Mites" — H. H. J. Nesbitt
"Colour Photography of Some Lepidopterous and Tenthredinid Larvae" — Miss M. R. MacKay
"Substitutes for Mercury Bichloride in Cabbage Maggot Control — W. G. Matthewman and J. P. Perron
"Progress Report on Experiments with Aerosols Under Canadian Conditions" — H. A. U. Monro, L. J. Briand, R. Delisle and C. C. Smith
"A Report on Some Recent Insecticide Developments in the United States" — C. R. Twinn
"Some of the Problems in Appraising Insecticide Requirements in Canada" — G. F. Manson
"The Feeding Habits of the White Grubs of Phyllophaga" — G. H. Hammond
"Practical Problems in Warble Fly Control" — R. H. Painter
"Pear Psylla Control in British Columbia" — W. N. Keenan

At the business meeting following the programme, the Nominations Committee submitted a list of councillors and directors.

The Resolutions Committee submitted resolutions expressing regret at the death of two outstanding members, Dr. L. S. McLaine and Dr. W. E. Saunders, with instructions that letters of condolence be forwarded by the Secretary to the families of these members.

The Directors' meeting was held on the morning of November 11. At this meeting, President C. E. Petch, Vice-President A. B. Baird and Secretary-Treasurer R. W. Thompson were re-elected to their respective offices, and the Secretary-Treasurer was instructed to prepare for publication a report of the Central and Regional Meetings.

The Western Ontario Regional Meeting of the Society was held in the Dominion Public Building and in the Plant Inspection Office in Toronto on November 17. In the absence of the President and the Vice-President, Mr. W. A. Ross, a Past President of the Society, occupied the chair.

As a matter of general business the editorial policy as outlined from the Council to the general business meeting in Ottawa was discussed and it was moved and seconded "that the meeting recommend to the Council of the Society that the President prepare a circular over his name to be sent to those in charge of economic entomology soliciting economic papers for inclusion in the *Canadian Entomologist*".

The matter of book reviews was introduced by Mr. W. A. Ross. It was suggested that those in the particular fields involved should be approached with respect to the preparation of book reviews for publication in the *Canadian Entomologist*.

The following programme of papers was presented:

"A Report of the November 10th meeting held at Ottawa" — R. W. Thompson, Guelph
"Substitutes for Lead Arsenate in Sprays for the Control of Imported Cabbage Worm" G. G. Dustan, Vineland
"Further Experiments in the Use of Molasses-free Baits for the Control of Cutworms in Tobacco Fields" — D. A. Arnott, A. A. Wood, H. B. Wressell, Chatham; H. W. Goble, R. K. Chapman, Guelph.
"Work with Substitute Insecticides in Southwestern Ontario" — H. B. Wressell, Chatham.
"Preliminary Experiments with Dichlor Diphenyl Trichloroethane (DDT) on Several Species of Insects, a Mite and a Crustacean" — G. G. Dustan, Vineland.
"Corn Sprays" — H. B. Wressell, Chatham
"The Effect of Selective Breeding on the Sex ratio and Fertility of *Microplectron fuscipennis* Zett. (chalcid)" — A. Wilkes, Belleville.
"An Interesting Occurrence of *Musca domestica* Larvae in Infant Bedding" — R. K. Chapman, Guelph.
"Quantitive Studies on the Monarch Butterfly, *Danaus archippus* Fab." — G. Beall, Chatham.
"Colour Changes in the *Mantis religiosa* L." — H. G. James, Belleville.
"Corn Borer Situation in Ontario in 1943" — R. W. Thompson, Guelph.
"Multiple Generation *Pyrausta nubilalis* Hbn. on Plants Other Than Corn in Ontario" — G. Beall, Chatham; G. Wishart, Belleville.
"Brief Summary of Japanese Beetle Situation in 1943" — W. A. Fowler, Toronto.
"Drosophila as a Test Insect for Stomach Poisons" — Frank Lord, Annapolis Royal, N.S.
"*Calocoris norvegicus*, a Strawberry Pest in Nova Scotia" — A. D. Pickett, Annapolis Royal; Donald MacLeod, N. S. Dept. of Agriculture.
"Molasses-free Bait for Earwigs" — A. G. McNally, Guelph.

Twenty-seven members and friends were in attendance at this meeting. The various topics introduced by the above programme were discussed at considerable length.

The Third Annual Regional Meeting of the Montreal Branch of the Entomological Society of Ontario was held at Macdonald College, on November 20, 1943. Twenty-seven members and friends were in attendance, Mr. G. A. Mooré, President of the Branch, was in the chair. Mr. C. E. Petch, President of the Society, gave an account of the meeting held in Ottawa on November 10.

The following programme of papers was presented.

"Anal Cross-Vein of Gomphidae"—Rev. O. Fournier (Lantern)
"Toxicity Data, A Function of the Variety of the Test Animal"—Frank O. Morrison
"White Grub Control"—Georges Gauthier
"Nouveau procédé pour le diagnostic des espèces du genre *Philonthus* (Staphylinidès)"—Brother Adrien Robert, C.S.V. (Lantern)
"Premier aperçu sur les Odonates du comté d'Abitibi"—Brother Adrien Robert, C.S.V., (Lantern)
"The Role of Forest Management in Forest Insect Control"—J. J. deGryse
"Comparative Results of Investigations on the Control of the Codling Moth in Quebec"—A. A. Beaulieu.
"Collecting Hemiptera at One Locality for Three Seasons: General Conclusions"—Geo. A. Moore
"Germ-Cell Formation and the Fate of Lethal Genes"—S. G. Smith
"Some of the Problems in Appraising Insecticide Requirements in Canada"—G. F. Manson
"A Report on Some Recent Insecticide Developments in the United States"—C. R. Twinn
"Symposium on Aerosols"—H. A. U. Monro, C. E. Petch, J. B. Maltais
"A New Pest on Black Willow in Quebec"—Joseph Duncan
"Factors Affecting the Increase of the Corn Borer Population in 1943"—Joseph Duncan
"The Mexican Bean Beetle in Quebec" — J. A. Doyle
"Contribution to the Study of the Orthoptera and Dermaptera of Quebec"—G. Chagnon

After the presentation of papers a tour was made of the departmental laboratories and of a special entomological exhibit. Supper was held in the Student Dining Hall, and following the meal the meeting was addressed by Colonel W. H. Brittain, Principal of Macdonald College. Colonel Brittain stressed the valuable work done by amateurs in the past and the necessity for all workers in entomology, both in the economic and systematic fields, to continue the study of the natural history of insects under field conditions in order to maintain proper perspective in their research.

R. W. THOMPSON.

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